Embedding Artificial Intelligent Applications in Higher Educational Institutions to Improve Students' Pronunciation Performance

Mohammad Ahmad Ibrahim Al-Shallakh
Al-Ahliyya Amman University, Jordan

Abstract—**This study investigates the integration of Elsa Speak, an Artificial Intelligence (AI) application, into higher education to enhance the pronunciation skills of English Foreign Language Learners (EFLL) at a Jordanian university. Grounded in a comprehensive literature review, this study adopts a mixed-methods approach, utilizing a pre-post-test-controlled group design with a sample of 12 students. The seven-week intervention employing Elsa Speak demonstrates a significant improvement in pronunciation skills, supported by statistical analyses and positive student perceptions gathered through questionnaires. The findings contribute to the broader discourse on AI in education, highlighting the practical impact of such applications on language learning, specifically pronunciation improvement in higher education. The study advocates the continued exploration and strategic integration of AI tools, such as Elsa Speak, into language education practices.**

Index Terms—**pronunciation, performance, improvement**

I. INTRODUCTION

A range of studies have explored the application of Artificial Intelligence in education, with a focus on Latin American higher education (Salas-Pilco, 2022), K-12 education (Murphy, 2019; Zafari, 2022), and international student experiences in higher education (Wang, 2023). These studies have identified various AI applications, including predictive modeling, intelligent analytics, assistive technology, automatic content analysis, and image analytics (Salas-Pilco, 2022), as well as machine learning and intelligent tutoring systems (Zafari, 2022). They have also highlighted the potential of AI to support teachers in addressing classroom challenges (Murphy, 2019) and enhance the educational experiences of international students (Wang, 2023). However, they have raised concerns about privacy, cultural differences, language proficiency, and ethical implications (Wang, 2023).

The use of technology in society presents significant challenges for individuals and institutions worldwide. Artificial Intelligence (AI) stands out as a primary source of these challenges, offering opportunities and advantages, as well as potential drawbacks and disadvantages at various levels. As technology becomes hotter and as they advance faster, these matters arise, showing adaptation to technological developments that are not linear behind technological advancements.

The use of Artificial Intelligence in teaching speaking skills has not been widely discussed, or embarrassed as a stand-alone area. The complex role of English Departments in Higher Education Institutions is at the core to the debate about the effect of Artificial Intelligence on learners' performance and their response to it.

The core of this paper is to investigate students' perspectives on the use and implementation of Artificial Intelligence to improve their speaking skills in academic institutions, such as universities and colleges.

This will be achieved by analyzing the advantages and disadvantages of college-level students through interviews conducted at a Jordanian university by gathering their perspectives through a distributed questionnaire. The research aims to contribute the enrichment of the strategies used by universities in implementing recent technologies in teaching and learning processes. The finding of this study will also contribute to the existing literature in this field. This structure of this study begins with a literature review on the implementation of this modern technology in educational institutions, followed by a discussion of the used methodology used and any limitations. Moreover, after presenting the findings, the results will be presented with a conclusion and recommendations for higher education management.

II. LITERATURE REVIEW

Artificial Intelligence is becoming more prevalent in higher education, with different potential applications in bespoke learning, intelligent tutoring systems, collaboration facilitation, and automated grading (Crompton, 2021; Diwaker, 2021). However, the integration of AI in higher education also gives raise to the ethical concerns (Crompton, 2021). In the era of AI age, higher education institutions need to adapt to equip students with the necessary skills for the evolving job market, focusing on technical capabilities, industry requirements, and AI literacy (Ma, 2019).

In high school education, Artificial Intelligence is being implemented in areas including machine learning and deep

learning. China has emerged as a significant player and influencer in this field (Triansyah, 2023). Different forms of e-learning technologies have been developed, updated, and used for educational programs. Ministries of education and universities have invested enormous efforts into increasing the use of online learning applications and websites in all their forms to meet the requirements of competitive markets and to bring a variety of e-learning options for students studying foreign languages (Carstens et al., 2021).

Although the use of Artificial Intelligence in higher education is becoming an essential area with recent developments within societies, Artificial Intelligence-based applications and tools have not been widely embedded in the higher education field. This resulted in a lack of sufficient evidence regarding the pedagogical impact of Artificial Intelligence on teaching and learning (O'Dea & O'Dea, 2023).

A. AI Applications in Education

A range of studies has explored the use of Artificial Intelligence in educational settings, highlighting its potential to enhance learning experiences and improve teaching quality. Jones (1985) and Manhiça (2022) both discuss the development of intelligent computer-assisted instruction systems and learning management systems, with the latter focusing the use of AI for student performance assessment. Panigrahi (2020) and Fahimirad (2018) further emphasize the transformative impact of AI on education, particularly in personalized learning, and the potential for enhancing learning outcomes. However, challenges such as the integration of AI in educational institutions and the need for student support these studies also acknowledged. Overall, these studies suggest that AI has the potential to significantly shape the future of education.

According to Ayala-Pazmiño and Alvarado-Lucas (2023), personalized learning is considered one of the essential benefits of consolidating Artificial Intelligence into language learning to provide personalized learning experiences. Learning that is based on the Artificial Intelligence mechanism can give and analyze the learners' performance to adapt the content of learning materials to meet the learners' needs and learning styles. Therefore, Artificial Intelligence in learning process applications found personalized content informatively improves learners' learning outcomes.

B. Pronunciation Improvement

Research has consistently emphasized the importance of pronunciation in language learning (Seyedabadi, 2015). Targeted pronunciation training, particularly in distance language learning context, has been found to significantly improve learners' perception and production skills (Martin, 2020). Computer-assisted pronunciation training (CAPT) has also been shown to be effective in improving word-level pronunciation skills, comparable to traditional teacher-led training (Neri, 2008). However, the neglect of English pronunciation in EFL/ESL classrooms, particularly in Asian contexts, has been attributed to the lack of available teaching strategies (Wei, 2006).

It has been stated in the literature that foreign language learners are still incompetent and suffer from weaknesses in oral communication (Al-Shallakh, 2023). Despite spending more than ten years learning English at school levels, learners may still lack the needed skills to master speaking. Personal reasons such as shyness and motivation on the one hand and inadequate teaching approaches employed by teachers may cause these weaknesses' outcomes (Diaab, 2016; Rahimi & Ong, 2023). These factors can contribute to the observed weakness in learners' speaking abilities.

The pandemic of COVID-19 uncovered many failing points in the traditional learning process since traditional learning depended on the physical attendance of the learners in the classroom, while the changed situation forced learners and institutions to work remotely. Therefore, all language-learning prospects have been changed accordingly to meet the learners' needs and improve the learning outcomes (Peng et al., 2023). Tang (2023) argued that investigating students' needs based on the needs theory is considered the basis for choosing the way of covering the gaps and improving the learners' performance based on their needs. This focus of tracking English for Academic Purposes has yielded in positive outcomes in the language domain.

Many studies have been conducted to investigate the learners' experiences in learning and teaching English as a second language. Approximately, the majority of these studies have highlighted the benefits of using technologies and Artificial Intelligence to improve language skills. This variation in the benefits derived from using AI can be attributed to factors such as learners' interests, motivation, and the selection of the appropriate application (Al-Shallakh, 2023; Fu et al., 2023; Liu, 2023).

Shefat (2023) stated that the importance of instructional technology lies in providing opportunities for students to have a variety of these experiences and develop their own. This allows them to think, observe, and understand. Overcoming the challenges of implementing this technology is important. The aim of the study was to examine the evidence of English language learners' use of instructional media and technology in English language teaching at Zerka Secondary School of Education from their perspective and identify the challenges they faced regarding information and education in the use of this technology.

The researcher employed a descriptive research method, and the research sample consisted of 166 teachers. A questionnaire with 23 items was used and distributed across two areas: English language learners use of instructional media and technology, and English language learners' challenges in using instructional media and technology. The results showed that the use of educational media and technology by the English language learners in Zerka Secondary Education Department was moderate, and the challenges they faced in utilizing media and technology functionality were also moderate. The results revealed no differences caused by academic variables (gender, academic level, and

years of experience) in the level of technology and media use or the difficulties English learners faced in implementing this technology. The findings (suggestions and contributions) recommended encouraging English learners to use modern educational technology in teaching.

C. Higher Education Context

A range of studies have explored the application of Artificial Intelligence in higher education, especially focusing on learning management systems (Manhi ça, 2022), academic support services, and institutional and administrative services (Ali, 2021). These studies highlight the potential of Artificial Intelligence to enhance education quality, learning and teaching processes, and future career prospects (Slimi, 2021). However, they also emphasize the need for further investigation into the pedagogical, moral, social, cultural, and economic dimensions of Artificial Intelligence in education (Ali, 2021). The challenges and ethical issues associated with the adoption AI in education are also acknowledged (Tahiru, 2021).

Chand (2021) stated that speaking skills are considered a direct indicator of overall proficiency, with fluency as a quality indicator of learning. Many students, both in schools and universities encounter challenges with their fluency in English. He recommended transitioning students from traditional theoretical approach to autonomous learning, allowing for increased individual practice. This can be facilitated with appropriate artificially intelligent applications.

Many studies conducted by Noviyanti (2020), Adityarini (2022), Liu (2016), and Cengiz (2023) collectively demonstrate the potential of AI-based pronunciation applications in improving pronunciation in higher education. Both Noviyanti and Adityarini observed significant improvements in students' pronunciation, with Noviyanti emphasizing the importance real of communication alongside with AI use. Liu's study further supports these findings by showing a significant improvement in pronunciation quality. Cengiz's review emphasizes the importance of teacher support in maximizing the effectiveness of AI-based pronunciation instruction. However, the studies also highlight the need for further research, particularly in non-English languages and across different educational levels.

A range of studies has also explored the use of AI in higher education, particularly in the areas of academic support services, institutional and administrative services, and intelligent tutoring systems (Ali, 2021; Tahiru, 2021). These applications have the potential to revolutionize the educational landscape by offering customized content, innovative teaching methods, and enhanced assessment (Chassignol, 2018). However, the adoption of AI in education presents challenges, including ethical issues and the demand for further investigation into pedagogical, social, and cultural dimensions (Ali, 2021; Tahiru, 2021). Despite these challenges, the potential benefits of AI in education are significant, particularly adaptive learning, online learning processes, human-AI interaction, and the utilization of AI-generated data (Bozkurt, 2021).

The existing literature on AI in education, particularly in higher education, has primarily focused on the opportunities, benefits, and challenges associated with AI adoption (Tahiru, 2021; Ali, 2021; Ahmad, 2020; Zawacki-Richter, 2019). However, there is a lack of research specifically concerning the use of AI for pronunciation improvement in higher education. This gap presents an opportunity for future studies to explore the potential of AI in this field, considering its growing importance in language learning and communication skills development. Such research could also address the need for critical reflection on the risks and challenges of Artificial Intelligence in education, as well as its ethical and pedagogical dimensions (Ali, 2021; Zawacki-Richter, 2019).

The use of Artificial Intelligence in higher education field, particularly for personalized learning and language improvement, has been widely extensively explored in literature (Ali, 2021; Lydia, 2023; Tahiru, 2021; Chen, 2021). AI applications in higher education have been found to be beneficial in areas such as academic support services, institutional and administrative services, and language learning (Ali, 2021; Lydia, 2023; Tahiru, 2021; Chen, 2021). However, the adoption of AI in education also presents four challenges, including issues related to privacy, data security, bias, and ethics (Lydia, 2023; Tahiru, 2021). Despite these challenges, students have demonstrated a positive behavioral intention to utilized AI for language learning in higher education (Chen, 2021). These findings suggest that while there are opportunities for the use of AI in higher education, careful consideration of ethical and practical implications is necessary.

The use of AI in education, particularly in higher education, has been a topic of extensive research and discussion. Zhai (2021) and Ahmad (2020) highlight the potential of AI in various educational applications, including grading, retention prediction, and intelligent tutoring. Zekaj (2023) further emphasizes the potential of AI language models to enhance instructional support, while Shrungare (2022) underscores the transformative impact of AI on teaching and learning. However, the specific application of AI to pronunciation improvement in higher education is an area that requires further investigation. The potential benefits of AI in this context, such as personalized learning experiences and improved language instruction, make it a promising area for future research.

The speaking proficiency of English learners offer poses significant challenge. This paper aims to investigate the effectiveness of Elsa Speak, an artificial intelligent application in improving the pronunciation skills of English Foreign Language Learners in Jordan. The artificial intelligence applications, such as Elsa Speak, can help the learners learn autonomously, and they provide the learners with real-time feedback on their pronunciation, which allows them to practice repeatedly many times and enhance their pronunciation skills.

The main purpose of this study is to examine the productiveness of the Elsa Speak tool as a functional tool in enhancing the pronunciation skills of English as Foreign Language learners in Jordan. By testing the potential cons and

challenges associated with integrating Elsa Speak into classrooms. This paper is also looking forward to contributing to the growing body of recent knowledge on the application of Artificial Intelligent-based technologies in language learners.

Therefore, the main purpose of this study is two-fold. Firstly, it aims to investigate the effect and impact of Elsa Speak on the pronunciation skills of a group of learners in Jordan. Secondly, it aims to explore the learners' perceptions of using an artificial intelligence mobile learning platform like Elsa Speak. By examining both quantitative and qualitative aspects of learners' experiences, the researcher of this study hopes to gain insights into how Elsa Speak can be used to improve pronunciation and facilitate learning autonomously among Jordanian learners.

The expected findings of this research are expected to provide valued insights to educators, content makers, and other researchers interested in integration artificial intelligence and recent distant learning technologies to support foreign languages learning and pronunciation instructions. Eventually, merging artificial intelligence platforms such as Elsa Speak has the potential to revolutionize foreign language learners in Jordan.

Therefore, this paper hopes to answer the following research questions:

1- To what extent does Elsa Speak improve pronunciation skills in terms of comprehensibility and intelligibility in spoken English?
2- What are Jordanian learners' perceptions toward the effectiveness of the Elsa Speak application in enhancing their pronunciation skills?

III. Methodology

This experimental study aimed to examine whether the use of an application called Elsa Speak can enhance pronunciation skills and performance of Jordanian learners. To measure and evaluate learners' progress, a pre-post-tests controlled group design was applied to assess the comprehensibility and intelligibility of Jordanian learners' pronunciation of the English language.

Sample and Setting of the Study.

The current study's sample consisted of 12 students at the university still in the first academic year of 2023-2024. The students were majoring English language and literature program. The learners' language proficiency levels were approximately equal, they as were not allowed to enroll in the English department unless they pass the entrance exam with acceptable language competence. Additionally, they were not allowed to register for speaking courses unless their GPA was above 2.0. The pretest mean score was considered an important factor, which reflects that both groups did not significantly differ in terms of their English competence.

Instrument of the Research.

A. Tests

This research employs an experimental design that demonstrates the cause-and-effect relationship. In other words, it is applied in research to find the influence of one variable on another variable. Pre-test, treatment, and Post-tests were the methods used for collecting data from the participants. The procedures started at the beginning of the first academic semester. All participants' pronunciation skills were initially assessed by a pre-test to be the control point to measure the learners' performance progress at the endpoint of the research.

The students studied a seven-week period as a defined period to measure their performance in speaking and pronunciation skills and evaluate their engagement in the programs after getting the treatment. The post-test was conducted using Elsa Speak technology to measure their performance. The same lecturer conducted both assessments.

B. Questionnaire

The students' perceptions were collected through a questionnaire, which served as an effective tool for gathering learners' perceptions after they had utilized the Elsa Speak application to enhance their pronunciation skills within the proposed process. This questionnaire was answered by the students after applying the treatment. The questionnaire is a closed one that was answered by the same students. The questionnaire contains four options labeled strongly agree, agree, disagree, and strongly disagree, and they are numbered from 4 to 1 accordingly. It is used gather data in-depth data about the effectiveness of the application in improving the learners' pronunciation mastery.

IV. Data Collection and Analysis.

The researcher chose learners from the English Department at Amman Al-Ahliyya University. The sample included all students who had studied a course called Listening and Conversation.

Before beginning the classes, the researcher introduced the project objectives. Then, the researcher emphasized the importance of motivation for achieving the program's objectives. All the students took a pre-test to measure their pronunciation competence.

The researcher met with the learners for five weeks. During the first week, phonetic symbols were introduced to the learners along with their methods of production. In the second week, the researcher introduced the first group of diphthongs to the learners and instructed them to repeat them multiple times after hearing these diphthongs from an educated native speaker. The third week, the researcher applied the second group of diphthongs to be, as the second

week. In the fourth and fifth weeks, the researcher gave learners were given an access to Elsa Speak to apply and practice the same diphthongs. Learners autonomously at home also used this application to provide them with additional practice time for the diphthongs they learned in the classroom. Finally, learners were asked to practice what they had learned in front of the class.

After the applied treatment, a post-test was administered to the same learners. It contains 30 items about the learned diphthongs. The aim of this test was to determine if the students' pronunciation performance improved after applying the Elsa Speak application. The results of both tests then were computed to measure their performances.

Implementing the questionnaire is the last step after conducting the post-test, which is used to gain students' responses about the use of the Elsa Speak Artificial Intelligence application to enhance their pronunciation competence. A questionnaire was formed, including ten questions, and the answers were collected for analysis.

The results of both the tests and the questionnaire were analyzed and tabulated for further analysis.

V. DATA ANALYSIS

After conducting the tests, the findings were used to determine the significance of differences between the two tests. The learners were labeled with the letters 'ST' followed by numbers ranging from one to 12, as presented in the class. The measurement of learners' pronunciation criteria was defined as follows:

TABLE 1
PRONUNCIATION MEASUREMENT

Category	Range	Assessment Criteria
Excellent	86-100	The students' got 25 to 30 correct answers
Good	71-85	The students' got 22 to 24 correct answers
Average	56-70	The students' got 16 to 21 correct answers
Poor	Equal or less than 55	The students' got 1 to 15 correct answers

Based on the results of the tests, students' scores were categorized according to interpretation criteria, as presented in the table below:

TABLE 2
STUDENTS' CLASSIFICATION SCORE FOR THE TESTS

Classification	Score Range	Ability Scale
Excellent	86-100	4
Good	71-85	3
Average	56-70	2
Poor	Equal or less than 55	1

The students' pronunciation test answers were calculated using the following equation:
Score=student's correct answers / total point X100

After conducting the treatment and tests, the researcher utilized SPSS for calculating the learners' pronunciation mastery by determining the mean score of the learners' pronunciation tests. The Likert scale was employed as a tool to evaluate the ratings and scoring criteria of the questionnaire, as outlined below:

TABLE 3
LIKERT SCALE

Strongly Agree	Agree	Disagree	Strongly Disagree
4	3	2	1

TABLE 4
THE SCORE CRITERIA

Criteria	Score	Interpretation
Good	3.51 - 4.00	Most students strongly agree with the statement.
Quite Good	2.51- 3.50	Most students agree with the statement.
Less Good	1.51-2.50	Most students disagree with the statement.
Not Good	00-1.50	Most students strongly disagree with the statement.

The data collected from the questionnaire were computed and analyzed using the following formula to compute the respondents.

$$\text{Mean} \longrightarrow \quad X = \sum X / N$$
$$X = \text{Average}$$
$$\sum X = \text{Total Answer}$$
$$N = \text{Total question}$$

Two-sample t-tests were employed to compare independent tests. The mean scores on the students' pronunciation tests and their standard deviations were used to investigate whether there was a significant difference between the tests. The researcher used version twenty-five of SPSS to analyze the collected data, with a significance level set at $\alpha = 0.05$.

To interpret the collected data, the researcher formulated two hypotheses to determine and measure the significance of the study. First, the null hypothesis (H0), which states that there is no significant difference between the tests means. Second, the alternative hypothesis (H1), which suggests that there is a significant difference between means of the tests.

VI. FINDINGS

In the pre-test, the researcher computed the learners' correct answers to analyze their understanding of pronunciation. As stated earlier, SPSS was used to statistically compute the results of tests. Table 3 presents the learners' scores on the pretests along with their corresponding classifications.

TABLE 5
PRE-TEST STUDENTS' SCORES AND CLASSIFICATIONS

Students	Score	Classification
ST 1	32	Poor
ST 2	45	Poor
ST 3	59	Average
ST 4	23	Poor
ST 5	12	Poor
ST 6	24	Poor
ST 7	32	Poor
ST 8	22	Poor
ST 9	13	Poor
ST 10	24	Poor
ST 11	23	Poor
ST 12	64	Average

The previous table showed that only two students achieved an 'Average' score, whereas the remaining ten students' results' were classified as 'Poor'. None of the students obtained a 'Good' or 'Excellent' results on the same test.

After statistically applying the previous scores using SPSS, the results of the students can be seen as shown in the table below:

TABLE 6
PRE-TEST STUDENTS' SCORES STATISTICS

Type of Test	N	Minimum Score	Maximum Score	Mean	Std. Deviation	Std. Error Mean
Pre-Test	12	12	64	31.01	15.976	4.611

Based on the data in the previous table, the number of students who took the pre-test was 12. The highest score was 64, while the lowest score was 12. The mean score was 31.01, with a standard deviation of 15.976.

In the post-test, the students' results were calculated using the same method as in the pre-test. The results are presented the results below:

TABLE 7
POST-TEST STUDENTS' SCORES AND CLASSIFICATIONS

Students	Score	Classification
ST 1	45	Poor
ST 2	73	Good
ST 3	87	Excellent
ST 4	46	Poor
ST 5	44	Poor
ST 6	60	Average
ST 7	72	Good
ST 8	55	Average
ST 9	24	Poor
ST 10	57	Average
ST 11	66	Average
ST 12	92	Excellent

The previous table shows students' scores after receiving treatment. Two students scored 'Excellent' scores, while another two students also scored 'Good' grades, while four students scored in the 'Average' range, and another four students scored 'Poor'.

The researcher statistically analyzed the students' post-tests scores using the same program employed for the pre-test. The results are as follows:

TABLE 8
POST-TEST STUDENTS' SCORES STATISTICS

Type of Test	N	Minimum Score	Maximum Score	Mean	Std. Deviation	Std. Error Mean
Post-Test	12	24	92	63.75	18.504	5.341

As stated earlier, two sample t-tests were utilized to compare the mean of the independent tests.

TABLE 9
THE PAIRED SAMPLE T-TEST

Type of Test	N	Minimum Score	Maximum Score	Mean	Std. Deviation	Std. Error Mean
Pre-Test	12	12	64	31.08	16.6867	4.817
Post-Test	12	24	92	60.08	19.3271	5.5793

The previous table shows a paired sample t-test. The table shows data for 12 students who took both pre- and post-tests. The mean score for the pre- and post-tests were 31.01 and 63.75, respectively. Additionally, standard deviations for both tests were reported as 15.976 and 18.504. Finally, the standard error of the mean for the pre-test was 4.611, while it was 5.341 for the post-test.

TABLE 10
THE PAIRED SAMPLE CORRELATION

	Tests	N	Correlation	Sig.	p-value
Pair 1	Pre-test & Post-test	12	0.8662	0.333	0.00026

The correlation coefficient represented in the analysis is 0.866, indicating a strong positive correlation between the variables. The significance score of 0.422 suggests that there is no significant correlation between the variables. However, the p-value of 0.00026 indicates that the correlation is statistically significant, suggesting that the observed calculation is unlikely to have occurred by chances.

TABLE 11
THE PAIRED SAMPLE TEST

Descriptive Statistics					
	Mean	Standard Deviation	n	Standard Error Mean	Standard Error of Dif.
Group A	31.0833	16.6867	12	4.817	7.3710
Group B	60.0833	19.3271	12	5.5793	
Independent Samples t-Test					
t-Statistic	-3.9343	Result			
Degrees of Freedom	22	Reject the null hypothesis.			
Critical Value	2.0739	Conclusion			
95% Confidence Interval	[12.2542, 45.7458]	The first group is significantly different from the second Group, t (22) = -3.9343, p < .05. There are 95% confident that the mean difference lies between 12.2542 and 45.7458.			

The previous table shows the paired sample scores. The calculated (T-value) count is –3.9343, which falls below the degree of freedom (df) value of 22, and the t-critical value is –3.93, which is less than the p-value. This critical t-value from the table for corresponding degrees of freedom (df) of 22 leads to the rejection of Null Hypothesis (H0) and acceptance the Alternative Hypothesis (H1). This indicates that the use of the application Elsa Speak is effective in improving students' pronunciation mastery at the college level.

The researcher distributed the questionnaire to the class after completing the treatment and post-test. Professional experts in the field, receiving an evaluation score of 3.6, indicating reliability of effectiveness, validated the questionnaire. The main purpose of using the questionnaire was to obtain in-depth knowledge about the use of Elsa Speak from the students' perspectives. The collected data from the questionnaire are as follows:

TABLE 12
QUESTIONNAIRES' EVALUATION

Respondent No.	Responses' Mean	Category
1	3.21	Quite Good
2	3.60	good
3	3.64	good
4	3.22	Quite Good
5	2.88	Quite Good
6	3.43	Quite good
7	3.42	Quite Good
8	2.50	Less Good
9	2.12	Less Good
10	3.34	Quite Good
11	3.47	Quite Good
12	3.49	Quite Good
Total Average Mean	3.10	Quite Good

The previous table indicates that the students' average mean score of the students is 3.10, which is categorized quite good. This refers to students' agreeing with their statements presented in the questionnaire. It is also a clear indicator that the use of the Elsa Speak application enhances learners' performance in speaking and pronunciation. The results confirm that the learners' agreement regarding the use of Elsa Speak is acceptable and satisfactory in terms of helping them improving their peaking and pronunciation skills.

VII. DISCUSSION AND CONCLUSION

Based on the collected and computed results from the experimental session using the Artificial Intelligence application Elsa Speak to analyze the learners' performance mastery, there were notable positive differences in the post-tests results following conducting the treatment process. This positive improvement is obvious from the increase in the mean score from the pre-test score, which was 31.08, to the post-test mean score of 60.80. This indicates that the Artificial Intelligence application, Elsa Speak, achieved a significant improvement, as the post-test mean score was better than the pre-test mean score.

This research shows the effectiveness of the Artificial Intelligence Application Elsa Speak in mastering students' pronunciation performance, as indicated by the statistical score results. The data collected from SPSS and presented in the previous tables showed a significance value of -3.93 for the t-tailed computation, which was greater than the standard significance level of 0.05. ($-3.93 < 0.05$) This result directs the research to accept the alternative hypothesis and rejects null hypothesis indicating a significant difference in student's pronunciation mastery.

Our study seamlessly aligns with the prevailing literature on AI applications in education, particularly on the context of language learning and pronunciation improvement. Drawing from the rich tapestry of studies conducted by Salas-Pilco (2022), Murphy (2019), Zafari (2022), and Wang (2023), our research further contributes to the discourse by delving into the nuanced realm of AI's role in higher education, specifically focusing on pronunciation enhancement using Elsa Speak.

Indeed, Elsa Speak emerges as a corroborative example of the transformative potential of AI applications in an educational context. As highlighted in studies by Crompton (2021), Diwaker (2021), and Ma (2019), our findings affirm that AI, as exemplified by Elsa Speak, is not merely theoretical but yields tangible improvements in personalized language learning experiences, particularly in the domain of pronunciation.

Our study underscores the persistent importance of pronunciation in language acquisition, echoing the sentiments expressed by Seyedabadi (2015), Martin (2020), Shdefat (2023) and Neri (2008). By focusing on pronunciation in the context of higher education, the research responds to the challenges identified in the literature, particularly the neglect of pronunciation in ESL/EFL classrooms, as noted by Wei (2006). The research aims to contribute to the existing knowledge by shedding the light on the importance of pronunciation and offering insights into how AI applications like Elsa Speak can effectively address this area of language learning.

In addressing the specific needs of higher education, our study contributes to the ongoing dialogue initiated by Manhiça (2022), Ali (2021), and Slimi (2021). While acknowledging the potential benefits of AI in higher education, our research offers practical insights into the integration of Elsa Speak, shedding light on its efficacy in improving pronunciation skills at university level.

Methodologically, our study aligns with the rigorous approaches advocated by Jones (1985), Panigrahi (2020), and Ayala-Pazmiño (2023). The amalgamation of quantitative assessments through statistical analyses, including paired sample t-tests, with qualitative feedback from questionnaires reflects a methodological strength that resonates with broader literature on AI in education.

Limitations and Future Research:

Transparently acknowledging the limitations, akin to Noviyanti (2020) and Cengiz (2023), adds nuance to our study. Future research endeavors, building on the foundation laid by our study, should explore larger and more diverse samples to enhance generalizability, as suggested by Liu (2016) and Adityarini (2022). The implications of our findings extend beyond the confines of our study, echoing the sentiments expressed by Ali (2021), Tahiru (2021), and Bozkurt

(2021). We recommend the strategic integration of AI applications such as Elsa Speak into language education programs, in alignment with the evolving landscape of technology in education.

REFERENCES

[1] Adityarini, H., Fahdiansyah, M., & Novitasari, V. (2022). Enhancing students' pronunciation using android pronunciation application. *Advances in Social Science, Education and Humanities Research*. Retrieved January 6, 2024, from https://www.atlantis-press.com/proceedings/icolae-21/125974359

[2] Ali, M. & Abdel-Haq, M. (2021). Bibliographical analysis of artificial intelligence learning in higher education: Is the role of the human educator and educated a thing of the past? In M. Ali & T. Wood-Harper (Eds.), *Fostering Communication and Learning with Underutilized Technologies in Higher Education* (pp. 36-52). IGI Global. Retrieved December 13, 2023, from https://doi.org/10.4018/978-1-7998-4846-2.ch003

[3] Ayala-Pazmiño, M., & Alvarado-Lucas, K. (2023). Integrating artificial intelligence into English language education in educator: A pathway to improved learning outcomes. *593 Digital Publisher CEIT*, *8*(3-1), pp.679-687. Retrieved January 8, 2024, from https://doi.org/10.33386/593dp.2023.3-1.1862.

[4] Bozkurt, A., Karadeniz, A., Bañeres, D., Guerrero-Roldán, A., & Rodríguez, M. (2021). Artificial intelligence and reflections from educational landscape: A review of AI studies in half a century. *Sustainability*. Retrieved February 17, 2024, from https://www.semanticscholar.org/reader/2b44fd0e7875dc217f6877d25c70eb8c0e8051c7

[5] Carstens, K., Mallon, K., Bataineh, M., & Al-Bataineh, A. (2021). Effects of technology on student learning, TOJET: *The Turkish Online Journal of Educational Technology*, *20*(1). Retrieved January 15, 2024, from https://files.eric.ed.gov/fulltext/EJ1290791.pdf

[6] Cengiz, B. (2023). Computer-assisted pronunciation teaching: An analysis of empirical research. *Participatory Educational Research*. Retrieved December 8, 2023, from https://dergipark.org.tr/en/pub/per/issue/76200/1227599

[7] Chassignol, M., Khoroshavin, A., Klimova, A., & Bilyatdinova, A. (2018). Artificial intelligence trends in education: a narrative overview. *Procedia Computer Science*, *136*, 16-24. Retrieved January 25, 2024, from https://doi.org/10.1016/j.procs.2018.08.233

[8] Cooper, H. (1989). Integrating Research: *A Guide for Literature Reviews*, *28*(3), pp. 380-381 (2 pages) Retrieved February 2, 2024, from https://doi.org/10.2307/3172876

[9] Crompton, H., & Song, D. (2021). The potential of artificial intelligence in higher education. *Revista Virtual Universidad Católica Del Norte*, *62*, 1-4. Retrieved November 8, 2023, from https://doi.org/10.35575/rvucn.n62a

[10] Diaab, S. (2016). Role of faculty instructional methods in Libyan EFL learners speaking difficulties, *Procedia-Social and Behavioral Sciences*, *(232)* pp. 338-345. Retrieved January 13, 2024, from https://www.sciencedirect.com/science/article/pii/S1877042816312642

[11] Diwaker, C., Sharma, A., & Tomar, P. (2021). Artificial intelligence in higher education and learning. In S. Verma & P. Tomar (Eds.), *Impact of AI Technologies on Teaching, Learning, and Research in Higher Education* (pp. 62-72). IGI Global. Retrieved January 3, 2024, from https://doi.org/10.4018/978-1-7998-4763-2.ch004

[12] Fu, Y., Zhang, Z. & Yang, H. (2023). Design of oral English teaching assistant system based on deep belief networks. *Soft Comput*, *27*, 17403–17418. Retrieved January 4, 2024, from https://doi.org/10.1007/s00500-023-09211-8

[13] Fahimirad, M., & Kotamjani, S. (2018). A Review of the application of artificial intelligence in teaching and learning in educational contexts. *International Journal of Learning and Development*. Retrieved February 17, 2024, from https://www.macrothink.org/journal/index.php/ijld/article/view/14057

[14] Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., Kyriakidou, O., & Peacock, R. (2005). Storylines of research in diffusion of innovation: a meta-narrative approach to systematic review. *Social science & medicine*, *61*, 2, 417-30. Retrieved January 8, 2024, from https://pubmed.ncbi.nlm.nih.gov/15893056/

[15] Jones, M. (1985). Applications of artificial intelligence within education. *Computers & Mathematics With Applications*, *11*, 517-526. Retrieved December 4, 2023, from https://www.sciencedirect.com/science/article/pii/0898122185900549?via%3Dihub

[16] Kashif, A., Qadir, J., Al-Fuqaha, A., Iqbal, W., Elhassan, A., Benhaddou, D. & Ayyash, M. (2020). Artificial Intelligence in Education: *A Panoramic Review*. 10.35542/osf.io/zvu2n. Retrieved December 17, 2023, from https://www.researchgate.net/publication/342323576_Artificial _Intelligence in_ Education_A_Panoramic_Review

[17] Lydia, E.G., Vidhyavathi, P., & Malathi, P. (2023). AI in education: opportunities and challenges for personalized learning. *Industrial Engineering Journal*. Retrieved January 4, 2024, from http://www.journal-iiie-india.com/1_may_23/82_online.pdf

[18] Manhiça, R., Santos, A., & Cravino, J.P. (2022). The use of artificial intelligence in learning management systems in the context of higher education: Systematic literature review. *2022 17th Iberian Conference on Information Systems and Technologies (CISTI)*, 1-6. https://ieeexplore.ieee.org/document/9820205

[19] Martin, I.A. (2020). Pronunciation development and instruction in distance language learning. *Language Learning & Technology*, *24*, 86-106. Retrieved January 22, 2024, from https://scholarspace.manoa.hawaii.edu/server/api/core/bitstreams/d4ae5d5e-2fc7-454f-980c-82f54925b030/content

[20] Murphy, R.F. (2019). Artificial intelligence applications to support K-12 teachers and teaching: A review of promising applications, opportunities, and challenges. Perspective. *The RAND Corporation*. Retrieved January 16, 2024, from https://www.rand.org/content/dam/rand/pubs/perspectives/PE300/PE315/RAND_PE315.pdf

[21] Neri, A., Mich, O., Gerosa, M., & Giuliani, D. (2008). The effectiveness of computer assisted pronunciation training for foreign language learning by children. *Computer Assisted Language Learning*, *21*, 393 - 408. Retrieved November 18, 2024, from https://www.tandfonline.com/doi/full/10.1080/09588220802447651

[22] Noviyanti, S.D. (2020). Artificial intelligence (AI)-based pronunciation checker: An alternative for independent learning in pandemic situation. *ELT Echo: The Journal of English Language Teaching in Foreign Language Context*. Retrieved January 6, 2024, from https://www.semanticscholar.org/reader/9e16d784013e0f011de6faf8e52dfc63a7840d7f

[23] O'Dea, X., & O'Dea, M. (2023). Is artificial intelligence really the next big thing in learning and teaching in higher education? A Conceptual Paper. *Journal of University Teaching & Learning Practice*, *20*(5). Retrieved January 15, 2024, from https://doi.org/10.53761/1.20.5.05

[24] Panigrahi, C. (2020). Use of artificial intelligence in education. *The Management Accountant Journal*. Retrieved January 13, 2024, from http://dx.doi.org/10.33516/maj.v55i5.64-67p

[25] Peng, M., Xu, Y. & Xu, C. (2023). Enhancing students' English language learning via-m-learning: integration technology acceptance model and S-O-R model, Heliyon, *(9)*2. Retrieved January 26, 2024, from https://www.sciencedirect.com/science/article/pii/S2405844023005091

[26] Rahimi, M & Ong, K. (2023). Exploring expert teachers' cognitions and practices of teaching English speaking and their students' experiences and engagement, *System*, *(115)* Retrieved December 22, 2023, from https://www.sciencedirect.com/science/article/pii/S0346251X23000866

[27] Robinson, S. (2019). Factors to consider when reviewing and reconciling research findings: Methodological, statistical and theoretical. *Applied Neuropsychology: Child, 8*, 88 - 92. Retrieved January 8, 2024, from https://www.tandfonline.com/doi/full/10.1080/21622965.2017.1388237

[28] Salas-Pilco, S.Z., & Yang, Y. (2022). Artificial intelligence applications in Latin American higher education: a systematic review. *Int J Educ Technol High Educ 19*, 21. Retrieved January 16, 2024, from https://doi.org/10.1186/s41239-022-00326-w

[29] Sandelowski, M.J., & Barroso, J. (2003). Classifying the findings in qualitative studies. *Qualitative Health Research*, *13*, 905 - 923. Retrieved January 26, 2024, from https://journals.sagepub.com/doi/10.1177/1049732303253488

[30] Seyedabadi, S., Fatemi, A., & Pishghadam, R. (2015). Towards better teaching of pronunciation: Review of literature in the area. *Mediterranean journal of social sciences*, *6*, 76. Retrieved November 23, 2023, from https://www.semanticscholar.org/reader/d14eed6c695768edc65ef0a15d93201a628dbd7a

[31] Shefat, N. (2023). The reality of English language teachers' use of educational media and technologies in teaching English in the second Zarqa Education directorate from their perspective. *Al-Balqa Journal for Research and Studies*, *26*(2), 63-76. Retrieved January 15, 2024, from https://doi.org/10.35875/1105-026-002-004

[32] Shrungare, J. (2022). AI in education, *The ACM Magazine for Students*, *29*(1), pp. 63–65. Retrieved January 18, 2024, from https://doi.org/10.1145/3589657

[33] Slimi, Z. (2021). *The impact of AI implementation in higher education on educational process future: A systematic review*. Retrieved November 19, 2023, from https://www.semanticscholar.org/reader/e1c05ee05fa9a9b31c2a0608eb4e2bb59db0416b

[34] Sze-Chu L. & Po-Yi H. (2016). Teaching pronunciation with computer assisted pronunciation instruction in a technological university. *Universal Journal of Educational Research*, *4*(9), 1939 - 1943. DOI: 10.13189/ujer.2016.040902. Retrieved January 14, 2024, from https://www.hrpub.org/journals/article_info.php?aid=5027

[35] Tahiru, F. (2021). AI in education: a systematic literature review. *J. Cases Inf. Technol.*, *23*, 1-20. Retrieved January 9, 2024, from https://www.igi-global.com/gateway/article/full-text-html/266434

[36] Tang, J. (2023). Artificial intelligence-based needs analysis for English specific purposes in digital environment, *Learning and Motivation*, *(83)*. Retrieved January 23, 2024, from https://www.sciencedirect.com/science/article/abs/pii/S0023969023000450

[37] Triansyah, F., Muhammad, I., Rabuandika, A., Siregar, K., Teapon, N., & Assabana, M. (2023). Bibliometric analysis: Artificial intelligence (AI) in high school education. *Jurnal Ilmiah Pendidikan Dan Pembelajaran*, *7*(1), 112–123. Retrieved January 2, 2024, from https://doi.org/10.23887/jipp.v7i1.59718

[38] Wang, T., Lund, B., Marengo, A., Pagano, A., Mannuru, N., Teel, Z., & Pange, J. (2023). Exploring the Potential Impact of Artificial Intelligence (AI) on International Students in Higher Education: Generative AI, Chatbots, Analytics, and International Student Success. *Applied Sciences*. Retrieved January 6, 2024, from https://www.semanticscholar.org/reader/e3bbf0950ba0bc31ba991fdbfbd75b25ca3241ed

[39] Wei, M. (2006). *A Literature Review on Strategies for Teaching Pronunciation*. Retrieved January 8, 2024, from https://files.eric.ed.gov/fulltext/ED491566.pdf

[40] Zafari M., Bazargani S., Sadeghi-Niaraki A. & M. Choi, S. (2022). Artificial Intelligence Applications in K-12 Education: A Systematic Literature Review," in *IEEE Access*, *vol. 10*, pp. 61905-61921, Doi: 10.1109/ACCESS.2022.3179356. Retrieved January 29, 2024, from https://ieeexplore.ieee.org/document/9785805

[41] Zhai X., Chu X., Chai, C. Jong, M. Istenič, A. Spector M., Liu J., Yuan J., & Li A. (2021). *Review of artificial intelligence (AI) in education from 2010 to 2020*, Hindawi Retrieved January 24, 2024, from https://downloads.hindawi.com/journals/complexity/2021/8812542.pdf

[42] Zekaj, R. (2023) AI language models as educational Allies: enhancing instructional support in higher education, *International Journal of Learning, Teaching and Educational Research*, *22*(8), Retrieved January 8, 2024, from DOI: https://doi.org/10.26803/ijlter.22.8.7

Mohammad Al-Shallakh obtained his PhD in Applied Linguistics from Sultan Zainal Abdin University in Malaysia in 2022. He earned his Master's degree in applied linguistics from Middle East University, Jordan in 2010 and his Batchelor's degree in English Language and Literature from Al-Hussein Bin Talal University, Jordan in 2005. He is currently an assistant professor at Al-Ahliyya Amman University in the English Department. His main areas of interest are applied linguistics, autonomous learning, teaching, learning, and problem solving.